



Developing Students' Movement Independence: Internalizing Physical Literacy in Project-based Physical Education Learning

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Abstract

Background. This study examines the urgency of developing students' movement independence through internalizing physical literacy in physical education learning according to Project-Based Learning (PBL).

Objectives. The study aimed to explore the impact of internalizing physical literacy in physical education learning according to PBL on students' movement independence.

Materials and methods. The method used was a quantitative approach with a pseudo-experimental design, involving students of State Aliyah Madrasah Barito Kuala Regency, grade XI as the population. The sample consisted of two treatment classes (XI-A and XI-B) and two control classes (XI-C and XI-D), each with 40 students. The research instrument was a movement independence questionnaire, which was divided into 4 indicators: 1) responsibility, 2) initiative, 3) confidence, and 4) problem solving. The data analysis technique used the analysis of variance (ANOVA) to compare the results between the treatment and control classes.

Results. The findings showed that the indicators of responsibility and confidence had a very significant difference between the experimental group and the control group, with a Sig. (2-tailed) = 0.000 < 0.05 on both indicators. In the initiative and problem solving indicators, there was no substantial difference between the experimental group and the control group, with a Sig. (2-tailed) values of 0.894 and 0.062 > 0.05 respectively. Overall, the experimental group provided better results than the control group. The results indicated that the application of PBL to physical literacy internalization significantly increased students' movement independence, especially in the indicators of responsibility and confidence.

Conclusions. The conclusion of this study confirms that the internalization of physical literacy in physical education learning according to PBL is effective in increasing students' movement independence.

Keywords: movement independence, physical literacy, project-based learning.

Introduction

Physical education is one of the important disciplines in developing students' character and skills. In this context, physical literacy becomes a crucial concept to be understood and internalized by students. Physical literacy includes the

ability to move with motivation, confidence and competence, as well as an understanding of the importance of physical activity in everyday life (Cairney et al., 2019). In an era where sedentary life style is increasing, understanding and developing physical literacy is vital.

However, many students face challenges in developing movement independence. Research shows that a lack of practical experience in movement and an inability to explore different physical activities can hinder their development of independence (Vorotilkina et al., 2022). Traditional approaches to physical education learning often do not

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provide space for students to innovate and experiment with different movements (Becheva & Vakrilov, 2015). One approach that can overcome this problem is Project-Based Learning (P-BL). P-BL encourages students to be actively involved in the learning process through P-BL that is relevant to their lives. By involving students in P-BL that requires movement skills, it is expected that they can internalize physical literacy values and increase their movement independence (Coyne et al., 2016).

In implementing P-BL, students not only learn physical skills, but also understand the meaning and benefits of physical activity. Research by Widiyana, I et al., (2022) shows that P-BL contributes to the improvement of students' motor skills and their self-confidence. This is important, as more confident students tend to participate more actively in physical activities. Independence of movement is an important element in the development of physical literacy. Students who are independent in movement have the ability to take initiative in physical activities, which in turn improves their health and fitness (Kairgozhin et al., 2023). Therefore, it is important to explore how the internalization of physical literacy through P-BL can improve students' movement independence.

Although many studies have examined the relationship between P-BL and physical skills, there is still a gap in the literature exploring the influence of internalizing physical literacy in this context. This study aims to fill that gap by investigating the impact of P-BL on students' movement independence, especially in the context of physical education. In addition, factors such as teacher support, a conducive learning environment, and students' intrinsic motivation also play an important role in the development of movement independence (Vorotilkina et al., 2022). In the implementation of P-BL, the role of the teacher as a facilitator is very important to guide students in finding solutions and building skills independently.

Movement independence also includes mental and emotional aspects. Students who feel independent in movement tend to have a higher sense of responsibility towards their health. Rois & Almaulidia, (2023) showed that students who engaged in active learning had higher self-confidence and were more responsible for their physical health. By promoting physical literacy through P-BL, we not only train students' physical skills, but also build a strong foundation for movement independence (Silverman & Mercier, 2015). This research is expected to contribute significantly to the development of a more effective and engaging physical education curriculum.

This study introduces novelty by integrating the Project Based Learning (P-BL) approach specifically in physical education learning, with a focus on developing students' movement independence. Although P-BL has been applied in various educational contexts, its application in physical education and its relationship with the internalization of physical literacy has not been widely researched.

One of the theories that supports this novelty is the Self-Directed Learning Theory proposed by Loeng (Loeng, 2020). This theory emphasizes the importance of students to take initiative in their learning process, which is in line with the principles of P-BL. According to research by Husnan et al., (2023), the use of active methods such as P-BL can develop physical literacy and increase student participation

in physical activity. In addition, research by Exkwantri et al. (Exkwantri et al., 2023) shows that P-BL can improve student learning outcomes. However, this study will delve deeper into how the implementation of P-BL can facilitate the development of students' movement independence, complementing previous research that has not explored this relationship specifically.

With this approach, it is hoped that this research can make a significant contribution to the development of a physical education curriculum that is more innovative and responsive to students' needs. The results of this study are also expected to inspire educators to implement more interactive and effective methods in physical education learning, so that students can be better prepared to face the challenges of an ever-evolving world, and become active and healthy individuals throughout their lives.

Materials and Methods

Participants

The population of this study were all students of State Aliyah Madrasah Barito Kuala Regency, South Kalimantan Province, precisely class XI consisting of 4 classes, namely class XI-A, XI-B, XI-C and XI-D. The entire population was used as a research sample or population research. The experimental class is class XI-A and XI-B and the control class is class XI-C and XI-D, each consisting of 40 students. The division of classes is done by purposive sampling because it considers the learning schedule set by the school with the assumption that the condition of students' abilities is homogeneous (Taherdoost, 2016). Data collection in this study was conducted following the Declaration of Helsinki and received approval from the University Ethics Committee.

Research Design

Type of Research, This research uses a quantitative approach with a quasi-experimental design with a control group time-series design (Leppink, 2019; Vaughn, Debbie & Lomax, 2020). The research design picture is as follows:

Treatment	T ₁	x	T ₂	x	T ₃
Control	T ₁	-	T ₂	-	T ₃

The treatment group is the group that is given the treatment of internalizing physical literacy based on the P-BL Model. The control group is a group that is treated with a direct learning model (direct instruction). Quantitative research allows researchers to measure variables statistically and test hypotheses through systematic testing.

The variables of this study consist of independent variables, namely the internalization of P-BL-based physical literacy while the dependent variable is the independence of student movement. The research instruments used in this study were questionnaires and observation sheets to measure students' movement independence. The questionnaire was designed based on the theory (Kaygozhin et al., 2022) that movement independence is divided into indicators; 1) responsibility, 2) initiative, 3) confidence, and 4) able to solve problems.

The procedure for implementing the research through treatment to the experimental class and the control class.

The experimental class received treatment with learning to apply internalization of physical literacy based on P-BL, while the control class received learning using a direct instruction learning model. The experimental class and the control class both underwent treatment once a week with a learning duration of 3 X 45 minutes = 135 minutes, namely during Physical Education class hours. Treatment in the experimental class by applying internalization of physical literacy learning based on P-BL is by following the P-BL learning syntax which begins with; 1) identification of basic problems/questions, 2) project planning, 3) information collection, 4) solution development, 5) application and realization of solutions, 6) presentation of results, 7) reflection and evaluation (Helle & Olkinuora, 2020; et al., 2016). In the implementation of learning, the experimental class is integrated with the principle of physical literacy, namely the instillation of an active culture of moving routinely and continuously with high understanding and motivation and self-confidence (Lounsbury & McKenzie, 2015). The integration of physical literacy principles in learning is given to students through the stages/ syntax of the P-BL model learning, especially at the reflection and evaluation stages, at the stage the teacher investigates the stages of each student's project and provides process feedback on each learning process every week. So it is very possible that learning in the experimental class, students who understand the core material well and have high motivation and self-confidence, then students will practice the learning material again outside of class hours several times a week. While in the control class by implementing a direct instruction learning

model, namely learning that follows the following syntax; 1) delivery of learning objectives, 2) giving instructions, 3) demonstrations and directed exercises, 4) feedback, 5) conclusions and independent assignments (Yanti, 2019; Zhu & Tongdecharoen, 2023). After the learning is complete, the teacher repeats the same thing by continuing the learning material the following week.

Statistical Analysis

Data analysis begins with prerequisite tests including normality and homogeneity tests to ensure that the data meets statistical assumptions. The Shapiro-Wilk test is used for normality, and the Levene test for homogeneity (Harrison et al., 2020). Data analysis tested the hypothesis using ANOVA to compare the results between the experimental and control groups. Tukey's follow-up test was used to determine specific differences between groups (Larini & Barthes, 2018).

Results

The data on student movement independence obtained by the researchers were then tested for preliminary analysis which included; 1) data normality test and 2) data homogeneity test, before testing the research hypothesis. The results of the preliminary analysis test are as follows

Table 3 shows the ANOVA test results for several indicators in the treatment and control classes, including responsibility, initiative, confidence, and problem solving. In the responsibility indicator in the treatment class, the value

Table 1. Normality Test Results of Movement Independence Data

Group		Shapiro-Wilk				Category
		Statistic	df	Sig.	p	
Treatment	Pre-test	0.955	40	0.114	0.05	Normal
	Middle-Test	0.982	40	0.761	0.05	Normal
	Post-test	0.976	40	0.531	0.05	Normal
Control	Pre-test	0.975	40	0.510	0.05	Normal
	Middle-Test	0.967	40	0.297	0.05	Normal
	Post-test	0.965	40	0.251	0.05	Normal

Table 2. Homogeneity Test Results of Student Movement Independence Data

Results		Levene Statistic	df 1	df 2	Sig.	p	Category
Independence of Movement	Based on Mean	.186	5	234	.968	0.05	Homogeneous
	Based on Median	.172	5	234	.973	0.05	Homogeneous
	Based on Median and with adjusted df	.172	5	228.199	.973	0.05	Homogeneous
	Based on trimmed mean	1.348	5	234	.245	0.05	Homogeneous

Table 3. ANOVA Test Results

Indicator	Sum of Squares	df	Mean Square	F	Sig.
Responsibility in the Treatment Class	39.650	2	19.825	3.600	0.030
Responsibility in the Control Class	1208.150	2	604.075	117.564	0.000
Initiative in the Treatment Class	94.850	2	47.425	1.771	0.175
Initiative in Control Class	0.517	2	0.258	0.084	0.920
Self-Confidence in the Treatment Class	67.200	2	33.600	3.292	0.041
Self-Confidence in Control Class	1110.650	2	555.325	79.415	0.000
Problem Solving in the Treatment Class	6.817	2	3.408	0.461	0.632
Problem Solving in the Control Class	1.517	2	0.758	0.099	0.905

Table 4. Further Test with Tukey

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Responsibility in the Treatment Class	Pretest	Middle test	-1.32500*	0.52475	0.034
		Posstest	-1.07500	0.52475	0.105
	Middle test	Pretest	1.32500*	0.52475	0.034
		Posstest	0.25000	0.52475	0.883
	Posstest	Pretest	1.07500	0.52475	0.105
		Middle test	-0.25000	0.52475	0.883
Responsibility in the Control Class	Pretest	Middle test	-1.00000	0.50687	0.123
		Posstest	6.17500*	0.50687	0.000
	Middle test	Pretest	1.00000	0.50687	0.123
		Posstest	7.17500*	0.50687	0.000
	Posstest	Pretest	-6.17500*	0.50687	0.000
		Middle test	-7.17500*	0.50687	0.000
Initiative in the Treatment Class	Pretest	Middle test	-2.15000	1.15708	0.156
		Posstest	-0.77500	1.15708	0.781
	Middle test	Pretest	2.15000	1.15708	0.156
		Posstest	1.37500	1.15708	0.462
	Posstest	Pretest	0.77500	1.15708	0.781
		Middle test	-1.37500	1.15708	0.462
Initiative in Control Class	Pretest	Middle test	-0.02500	0.39227	0.998
		Posstest	-0.15000	0.39227	0.923
	Middle test	Pretest	0.02500	0.39227	0.998
		Posstest	-0.12500	0.39227	0.946
	Posstest	Pretest	0.15000	0.39227	0.923
		Middle test	0.12500	0.39227	0.946
Self-Confidence in the Treatment Class	Pretest	Middle test	-1.20000	0.71436	0.217
		Posstest	0.60000	0.71436	0.679
	Middle test	Pretest	1.20000	0.71436	0.217
		Posstest	1.80000*	0.71436	0.035
	Posstest	Pretest	-0.60000	0.71436	0.679
		Middle test	-1.80000*	0.71436	0.035
Self-Confidence in Control Class	Pretest	Middle test	-0.25000	0.59130	0.906
		Posstest	6.32500*	0.59130	0.000
	Middle test	Pretest	0.25000	0.59130	0.906
		Posstest	6.57500*	0.59130	0.000
	Posstest	Pretest	-6.32500*	0.59130	0.000
		Middle test	-6.57500*	0.59130	0.000
Problem Solving in the Treatment Class	Pretest	Middle test	-0.37500	0.60801	0.811
		Posstest	0.20000	0.60801	0.942
	Middle test	Pretest	0.37500	0.60801	0.811
		Posstest	0.57500	0.60801	0.613
	Posstest	Pretest	-0.20000	0.60801	0.942
		Middle test	-0.57500	0.60801	0.613
Problem Solving in the Control Class	Pretest	Middle test	0.15000	0.61757	0.968
		Posstest	0.27500	0.61757	0.897
	Middle test	Pretest	-0.15000	0.61757	0.968
		Posstest	0.12500	0.61757	0.978
	Posstest	Pretest	-0.27500	0.61757	0.897
		Middle test	-0.12500	0.61757	0.978

of $F = 3.600$ with $\text{Sig.} = 0.030$ indicates a significant difference between groups. Meanwhile, in the control class, the value of $F = 117.564$ with $\text{Sig.} = 0.000$ shows a very significant difference. For the initiative indicator, the experimental class obtained a value of $F = 1.771$ with $\text{Sig.} = 0.175$, which

indicates no significant difference between groups. Similar results were also seen in the control class, with a value of $F = 0.084$ and $\text{Sig.} = 0.920$. On the confidence indicator, the treatment class showed a value of $F = 3.292$ with $\text{Sig.} = 0.041$, which means there is a significant difference between

Table 5. Independent Significance Test Results

Indicator	Variants	F	Sig.	t	df	Sig. (2-tailed)
Responsibility	Equal variances assumed	3.339	0.072	14.257	78	0.000
	Equal variances not assumed			14.257	72.843	0.000
Initiative	Equal variances assumed	0.716	0.400	-0.134	78	0.894
	Equal variances not assumed			-0.134	76.851	0.894
Confident	Equal variances assumed	1.579	0.213	10.252	78	0.000
	Equal variances not assumed			10.252	75.636	0.000
Solving Problems	Equal variances assumed	0.384	0.537	1.894	78	0.062
	Equal variances not assumed			1.894	77.424	0.062

groups. On the other hand, in the control class, the value of $F = 79.415$ with $\text{Sig.} = 0.000$ shows a very significant difference. For the problem solving indicator, the results in the treatment class showed a value of $F = 0.461$ with $\text{Sig.} = 0.632$, so there is no significant difference between groups. Similarly, in the control class, with a value of $F = 0.099$ and $\text{Sig.} = 0.905$, no significant difference was found.

Overall, in the treatment class, the responsibility and confidence indicators showed significant differences, while the other indicators did not. In contrast, in the control class, responsibility and confidence showed a very significant difference, while the other indicators still did not show a significant difference. A more detailed explanation of the results can be seen in table 4.

Based on Table 4 of the Tukey test results, it can be seen that in the responsibility indicator, the experimental class showed a significant difference between the pretest and the middle test ($\text{Sig.} = 0.034$), but there was no significant difference in other comparisons. In contrast, the control class recorded highly significant differences from pre-test to post-test and from middle test to posttest ($\text{Sig.} = 0.000$). For the initiative indicator, in both the treatment and control classes, no significant difference was found at all stages ($\text{Sig.} > 0.05$). In the confidence indicator, the experimental class only showed a significant difference between the middle test and posttest ($\text{Sig.} = 0.035$), while the control class recorded a very significant increase from pre-test to post-test and from middle test to post-test ($\text{Sig.} = 0.000$). As for the problem-solving indicator, there were no significant changes at any stage for both classes. Overall, significant changes were more frequent in the control class than the treatment class, especially in the responsibility and confidence indicators.

Based on Table 5. The results of the independent difference test, analysis using independent samples t-test shows that the indicators of responsibility and confidence have a very significant difference between the experimental group and the control group, with a $\text{Sig. (2-tailed)} = 0.000$ on both indicators. In the initiative and problem-solving indicators, no significant differences were found between the experimental and control groups, with a Sig. (2-tailed) values of 0.894 and 0.062, respectively. The results of Levene's test show that the assumption of equal variance is accepted for all indicators, because the $\text{Sig.} > 0.05$. Thus, it can be concluded that significant changes only occurred in the indicators of responsibility and confidence, while initiative and problem solving remained consistent with no difference between the experimental and control groups.

Discussion

The results showed that the internalization of physical literacy in P-BL-based physical education learning was able to increase students' movement independence. In addition, the increase in students' movement independence is seen from the indicators; 1) responsibility, 2) initiative, 3) self-confidence, and 4) solving problems based on the ANOVA test and Tukey test, the results show that there are significant differences in the indicators of responsibility and self-confidence while the aspects of initiative and problem solving are not.

This study indicates that students who are engaged in P-BL-based learning activities are more likely to be responsible for their tasks. This is in line with the theory proposed by Azizah & Wardani (Azizah & Wardani, 2019) and Wati et al. (Wati et al., 2024) which states that experiential learning, such as P-BL, can increase student engagement and encourage them to become more independent in the learning process. Furthermore Amini et al. (Amini et al., 2019) shows that students who engage in P-BL-based learning show an increase in responsibility, as they are required to complete tasks collectively and individually. This creates an awareness of the importance of their contribution in the group, thus increasing the sense of responsibility. This confirms that innovative methods such as P-BL can have a positive impact in physical education, similar to the findings in this study.

In addition to responsibility, the aspect of self-confidence also experienced a significant increase. Students who were given the opportunity to actively participate in P-BL felt more confident in their physical and social skills. According to Hossein-Mohand et al. (Hossein-Mohand et al., 2021) and Atmono et al. (Atmono et al., 2023) P-BL-based learning allows students to adapt to challenges and tackle problems head-on, which contributes to increasing their self-confidence (Sinaga et al., 2023). When students successfully complete tasks or challenges in P-BL, they will feel more confident to face similar situations in the future.

However, there is research by Estrada Olibier et al. (Estrada Oliver et al., 2020) which shows that not all students gained improvement in movement independence when using the P-BL method. The study found that external factors such as environmental support and student readiness strongly influenced the outcomes. This highlights the importance of context in the application of this method and suggests that the effectiveness of P-BL may vary depending on certain factors, such as 1) A conducive environment also plays a role in the successful implementation of the P-BL method. Rahayu et al. (Rahayu et al., 2018) emphasizes that a positive learn-

ing atmosphere can increase student motivation. Schools should create a supportive environment for students to learn actively. 2) The use of technology in P-BL learning can increase student interaction and engagement. Sudjimat, Dwi et al. (Sudjimat et al., 2021) points out that the integration of technology in learning can expand access to information and increase student participation. 3) The development of innovative learning media is essential to support the implementation of P-BL. Further research by Syukriah et al. (Syukriah et al., 2020) and Rosiana et al. (Rosiana et al., 2023) shows that the use of appropriate media can improve student understanding and engagement. Therefore, further research needs to be done to develop media that are appropriate to the learning context. 4) In the context of physical education learning, it is necessary to include health awareness elements to build students' understanding of the importance of physical activity. Suwiwa et al. (Suwiwa et al., 2023) showed that an understanding of health can increase students' motivation to participate in physical activity. 5) Creating space for students to be actively involved in the learning process. Septaliza et al. (Septaliza et al., 2024) indicates that actively engaged students are more likely to acquire the necessary skills. 6) The most important factor is the understanding of teachers who run the P-BL model in physical education learning. Mukti et al. (Mukti et al., 2020) shows that the lack of teacher understanding of this method can hinder the effectiveness of achieving the learning objectives set.

The implications of this study are very important for the development of physical education curriculum (Hardinata et al., 2024; Harianto et al., 2023; Mariati et al., 2024). The application of the P-BL method which proved effective in increasing students' movement independence suggests that this approach should be integrated into the curriculum. This is also in line with the view of (Cairney et al., 2019) which states that physical literacy is the key to building a healthy lifestyle. Some studies also provide information that physical literacy has a good impact on active skills for students (Mashud, Arifin, et al., 2023; Mashud, Warni, et al., 2023; Mashud et al., 2024).

Based on the research results, some recommendations that can be proposed are: 1) Intensive training is needed for teachers to understand and implement the P-BL method well. This training should include classroom management techniques and relevant curriculum development. 2) The physical education curriculum needs to be updated to include P-BL elements, so that students can learn in a more active way and be directly involved in learning. 3) Further research needs to be conducted to explore the factors that influence the effectiveness of P-BL in different contexts, including student variables such as initiative, problem solving, motivation and student background.

Overall, this study provides important insights into the positive impact of implementing P-BL-based physical literacy integration in physical education learning to increase students' movement independence. It is hoped that the results of this study can serve as a reference for the development of better educational practices in the future. By implementing the recommendations provided, it is hoped that the quality of physical education in Indonesia can improve.

Conclusions

This study shows that the application of P-BL-based physical literacy internalization in physical education

learning significantly increases students' movement independence, especially in the aspects of responsibility and self-confidence. The results of the analysis showed a significant difference between the treatment and control classes, which supports the hypothesis that interactive learning methods can facilitate the improvement of students' movement independence. Although there was no significant difference in the initiative and problem-solving indicators, the findings provide insight into the importance of innovative learning approaches in physical education.

Suggestions for future research are to explore more deeply the factors that influence learning outcomes, especially on the initiative and problem-solving indicators. In addition, it is important for educators to consider the integration of technology in learning and involve parents in the educational process to create a more supportive learning environment. Thus, it is expected that students can be more motivated and actively participate in physical activities, ultimately improving their overall movement independence

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Conflict of Interest

The authors declare that they have no conflicts interests.

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Розвиток рухової самостійності учнів: Інтерналізація фізичної грамотності в процесі навчання фізичного виховання з використанням проєктів

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 2 табл., 2 рис., 41 джерело.

Історія питання. У цьому дослідженні розглядається актуальність розвитку рухової самостійності учнів через завоювання фізичної грамотності в процесі навчання фізичного виховання за методом проєктів (навчання з використанням проєктів, НВП).

Мета дослідження. Мета дослідження полягала у вивченні впливу інтерналізації фізичної грамотності в процесі навчання фізичного виховання за методом проєктів на рухову самостійність учнів.

Матеріали та методи. У дослідженні застосовано кількісний підхід із псевдоекспериментальним дизайном, в якому учні Державної школи Медресе Алія, регенство Баріто Куала (State Aliyah Madrasah Barito Kuala Regency), XI клас, виступали в якості досліджуваної популяції. Вибірка складалася з двох експериментальних класів (XI-A і XI-B) і двох контрольних класів (XI-C і XI-D), кожен з яких налічував 40 учнів. Дослідницький інструмент — опитувальник рухової самостійності, який був розділений на 4 показники: 1) відповідальність, 2) ініціативність, 3) впевненість і 4) розв'язання задач. У методиці аналізу даних використовувався дисперсійний аналіз (ANOVA) з метою порівняння результатів між експериментальною та контрольною групами.

Результати. Отримані дані показали, що індикатори відповідальності та впевненості мають дуже значущу різницю між експериментальною та контрольною групами, при цьому двосторонній рівень значущості склав: Sig. (2-tailed) = 0,000 < 0,05 для обох індикаторів. За показниками ініціативності та розв'язання задач суттєвої різниці між експериментальною та контрольною групами не спостерігалось, при цьому Sig. (2-tailed) = 0,894 та 0,062 > 0,05 відповідно. Загалом, експериментальна група досягла кращих результатів, ніж контрольна група. Результати свідчать про те, що застосування НВП для засвоєння фізичної грамотності сприяло значному підвищенню рухової самостійності учнів, особливо за показниками відповідальності та впевненості.

Висновки. Проведене дослідження підтверджує, що засвоєння фізичної грамотності під час навчання фізичного виховання за методом проєктів є ефективним у підвищенні рухової самостійності учнів.

Ключові слова: рухова самостійність, фізична грамотність, навчання з використанням проєктів.

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